

## FACTORS ASSOCIATED WITH BLOOD TRANSFUSION IN THE POSTOPERATIVE PERIOD OF CARDIAC SURGERY

### *FATORES ASSOCIADOS À TRANSFUSÃO SANGUÍNEA NO PERÍODO PÓS-OPERATÓRIO DE CIRURGIA CARDÍACA*

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**ABSTRACT:** This study aims to identify the factors associated with blood transfusion in the postoperative period of cardiac surgery, and the predominant types of blood products used. Analytical and retrospective study carried out in a large teaching hospital located in Uberaba, Minas Gerais, Brazil. Data were collected from 460 medical records of patients who underwent cardiac surgery between July 2005 and July 2010. There were 290 (63%) patients received blood transfusions in the intra- and/or postoperative period. The mean age was 57.9 years; 59.6% were male; 74.8% presented with systemic arterial hypertension as a comorbidity; and 97.2% of the surgeries were elective, with myocardial revascularization being the most prevalent type of surgery. In the intraoperative period, 75 (25.9%) patients received blood transfusions, and in the postoperative period 273 (94.1%) patients received blood transfusions, with red blood cell concentrate being the predominant type of blood product used. There was a statistically significant association between postoperative blood transfusion and the variables age group, complications and intraoperative blood transfusion. Blood transfusion remains a frequent procedure in cardiac surgeries, and age group, complications and intraoperative blood transfusion were independent predictors for postoperative blood transfusion.

**KEYWORDS:** Cardiac surgery procedures. Blood transfusion. Epidemiology. Risk factors.

## INTRODUCTION

Cardiovascular disease has become the primary cause of morbimortality in Brazil. Cardiac surgery is an option when useful life expectancy is longer with surgical treatment than with clinical treatment (GALDEANO et al., 2012). Given the complexity of this surgical procedure, blood transfusions are often necessary in the perioperative period. Many factors can increase the risk of bleeding for these patients, which can result in blood transfusion during or following cardiac surgery (HALL et al., 2001; SOUZA; MOITINHO, 2008;).

Although it is a common procedure in highly complex surgeries, blood transfusion is not without risk, such as the occurrence of immediate or late transfusion reactions. According to Souza and Barbosa (2011; 2012), non-hemolytic fever and allergic reaction are among the common immediate reactions, primarily due to the concentration of red blood cells. Additionally, researchers have concluded that postoperative blood transfusion for cardiac surgery is associated with atrial fibrillation, stroke and acute renal failure, as well as infection of

the respiratory tract, mediastinitis and sepsis (DORNELES et al., 2011).

According to Souza and Moitinho (2008), some health care services have adopted strategies for reducing the use of blood products in patients undergoing cardiovascular surgery. However, studies that highlight factors related to postoperative blood transfusion are scarce.

Thus, the objective of this study was to identify factors associated with blood transfusion in the postoperative period of cardiac surgery, and the predominant types of blood products used.

## MATERIAL AND METHODS

### Study design

This is a retrospective, analytical study with a quantitative approach.

### Ethical considerations

This study is part of a larger project entitled “Occurrence of hospital infections in patients undergoing cardiac surgery,” approved by the Research Ethics Committee of the Universidade Federal do Triângulo Mineiro, under protocol number 1611/2012.

### Setting and samples

Data were obtained from 460 medical records of patients who underwent cardiac surgery between July 2005 and July 2010, in a large public teaching hospital located in Uberaba, Minas Gerais, Brazil. The Cardiac Surgery Service of the study hospital provided the numbers for the patient charts, which were then accessed by the Medical Records Service. The study included patients aged 18 years or over who underwent cardiac surgery. Patients whose medical record numbers were not identified or located were excluded from the study.

### Data collection

An instrument was developed to guide data collection, which was evaluated by three specialists in this subject matter.

### Analyzed variables

The variables analyzed were: sex, age, origin, body mass index (BMI), clinical condition according to the American Society of Anesthesiologists (2010), tobacco smoking, comorbidities, pre- and postoperative hospitalization time, use of antiplatelet drugs, classification, type and duration of surgery, use and length of time spent on cardiopulmonary bypass (CPB), sternal reopening, intraoperative blood transfusion, type and quantity of blood product used, and patient outcome (discharge, death or transfer).

### Measurements

The BMI variable was classified according to the definition by the World Health Organization (1998): underweight ( $<18.5 \text{ kg/m}^2$ ), normal weight ( $18.5 \text{ to } 24.9 \text{ kg/m}^2$ ), overweight ( $25.0 \text{ to } 29.9 \text{ kg/m}^2$ ), class I obesity ( $30.0 \text{ to } 34.9 \text{ kg/m}^2$ ), class II obesity ( $35.0 \text{ to } 39.9 \text{ kg/m}^2$ ) and class III obesity ( $\geq 40.0 \text{ kg/m}^2$ ).

The clinical condition variable was classified according to the *Physical Status Classification System* of the American Society of Anesthesiologists (2010): P1 (healthy patient), P2 (patient with mild systemic disease), P3 (patient with severe systemic disease), P4 (patient with severe systemic disease that is a constant threat to life), P5 (moribund patient who is not expected to survive without surgery), and P6 (brain-dead patient whose organs are being removed for donation).

### Data analysis

The data collected was entered twice into a Microsoft Excel® spreadsheet, and was subsequently validated. After being validated, the data was exported to *Statistical Package for Social Sciences* (SPSS), version 17, for analysis.

The qualitative variables were analyzed using descriptive statistics through distribution of absolute and percentage frequency. For the quantitative variables, the descriptive measurements of centrality (mean) and dispersion (minimum and maximum values) were used.

In order to identify the factors associated with blood transfusion in the postoperative period of cardiac surgery, a bivariate analysis was performed using the chi-squared test, with a significance level of 0.05. Following, multivariate analysis through logistic regression was performed, considering the variables presented in the bivariate analysis value of  $p < 0.1$ . The significance level of 0.05 was also adopted in the multivariate model. Note that in order to proceed to the bivariate and multivariate analyses, all of the studied variables were dichotomized.

## RESULTS

### General characteristics

In the period analyzed, of the 460 patients who comprised the study population, 290 (63.0%) received blood transfusions in the intra and/or postoperative period. The mean age of the study subjects was 57.9 years, with variation from 20 to 81 years; 173 (59.6%) of the patients were male, and 189 (65.2%) were from the municipality of Uberaba (MG). The mean BMI was  $25.4 \text{ kg/m}^2$ , and 71 (24.5%) of the patients were overweight. In regards to clinical condition according to the American Society of Anesthesiologists, 71 (24.5%) of the patients were classified as P3 (patients with severe systemic disease). In regards to tobacco use, 88 (30.3%) of the patients were smokers, 85 (29.3%) were non-smokers and 72 (24.8%) were former smokers.

In regards to primary comorbidities, it was verified that 217 (74.8%) of the patients had systemic arterial hypertension (SAH), 75 (25.9%) had diabetes mellitus (DM), 41 (14.1%) had chronic obstructive pulmonary disease (COPD), 25 (8.6%) had congestive heart failure (CHF), 13 (4.5%) had chronic renal failure, four (1.4%) had acute renal failure, and two (0.7%) had immunosuppressive disease.

### Characteristics related to surgery and blood transfusion

The mean preoperative hospitalization time was 7.9 days, with variation from one to 54 days. The mean preoperative hospitalization time in the intensive care unit (ICU) was 5.4 days, with variation from one to 26 days. The majority of the surgeries (282; 97.2%) were classified as elective,

and the mean duration time of the procedures was 4.1 hours, with variation from 1.9 to nine hours. Myocardial revascularization (MRV) was the most prevalent surgery, performed on 140 (48.3%)

patients (Table 1). The majority of the surgeries (97.9%) used CPB for a mean time of 83.4 minutes, with variation from ten to 260 minutes.

**Table 1.** Distribution of frequency of patients who received blood transfusions in the intra- and/or postoperative period (n=290), according to cardiac surgery performed. Uberaba-MG, 2005-2010.

Surgery	n	%
MRV	140	48.3
MVR	49	16.9
AVR <sub>O</sub>	44	15.2
MVR+AVR <sub>O</sub>	10	3.4
MRV+ AVR <sub>O</sub>	9	3.1
MRV+ MVR	6	2.1
Bentall	5	1.7
IAC	4	1.4
IVC	1	0.3
Other	22	7.6
<b>Total</b>	<b>290</b>	<b>100.0</b>

MRV: myocardial revascularization, MVR: mitral valve replacement. AVR<sub>O</sub>: aortic valve replacement, IAC: interatrial communication, IVC: interventricular communication

Seventy-five (25.9%) patients received blood transfusions during the intraoperative period; of these, 42 (56.0%) received only one type of blood product, and 33 (44.0%) received more than one

type. Red blood cell concentrate was the most frequently administered blood product, and a total of 125 units were used on 57 (76.0%) patients (Table 2).

**Table 2.** Distribution of types and quantity of blood products used in the intraoperative period of cardiac surgery. Uberaba-MG, 2005-2010.

Types of blood components used	Transfused patients (n= 75)		Total transfused units	Mean units/patient
	n	%		
Red blood cell concentrate	57	76	125	2.2
Fresh frozen plasma	29	38.7	99	3.4
Platelet concentrate	28	37.3	267	9.5
Cryoprecipitate	11	14.7	121	11.0

It was verified that 86 (29.6%) patients used antiplatelet drugs during the preoperative period, and 222 (76.6%) in the postoperative period. Nine patients (3.1%) underwent sternal reopening due to bleeding in the immediate postoperative period.

In the postoperative period, 273 (94.1%) patients received blood transfusions. Of these, 178 (65.2%) received just one type of blood product, and 95 (34.8%) patients received more than one type. Red blood cell concentrate was the predominant type of blood product used in the postoperative

period, with a total of 965 units transfused in 265 (97.1%) patients (Table 3).

In regards to the total postoperative hospitalization time, it was observed that the mean length of stay was 14 days, with variation from three to 76 days. The mean postoperative hospitalization time in the ICU was 9.3 days, with variation from two to 70 days. In regards to outcome of the study subjects, 240 (82.8%) were discharged from the hospital, and 50 (17.2%) died.

**Table 3.** Distribution of types and quantity of blood products used in the postoperative period of cardiac surgery. Uberaba, Minas Gerais, 2005-2010.

Types of blood components used	Transfused patients (n=273)		Total units transfused	Mean units/patient
	n	%		
Red blood cell concentrate	265	97.1	965	3.6
Fresh frozen plasma	93	34.1	353	3.8
Platelet concentrate	43	15.7	408	9.5
Cryoprecipitate	14	5.1	157	11.2

**Factors associated with blood transfusion**

In regard to factors that may be associated with blood transfusion in the postoperative period of cardiac surgery, the bivariate analysis showed that age group, presence of SAH, presence of COPD,

length of surgery, occurrence of complications in the intraoperative period, and blood transfusion in the intraoperative period were factors that were statistically significant ( $p < 0.05$ ) (Table 4).

**Table 4.** Bivariate analysis of risk factors and blood transfusion in the postoperative period of cardiac surgery. Uberaba, Minas Gerais, 2005-2010.

Variables	Blood transfusion in the post-operative period				p
	Yes		No		
	n	%	n	%	
<b>Sex</b>					
Male	167	59.6	113	40.4	0.872
Female	106	58.9	74	41.1	
<b>Age group</b>					
Elderly	132	71.4	53	28.6	<b>&lt; 0.001</b>
Adult	141	51.3	134	48.7	
<b>DM</b>					
Yes	69	65.7	36	34.3	0.131
No	204	57.5	151	42.5	
<b>SAH</b>					
Yes	205	63.1	120	36.9	<b>0.012</b>
No	68	50.4	67	49.6	
<b>COPD</b>					
Yes	39	75.0	13	25.0	<b>0.015</b>
No	234	57.4	174	42.6	
<b>Use of CPB</b>					
Yes	268	59.7	181	40.3	0.342
No	5	45.5	6	54.5	
<b>Duration of Surgery</b>					
4 hours or more	133	69.3	59	30.7	<b>&lt; 0.001</b>
Less than 4 hours	140	52.2	128	47.8	
<b>Complications in the intraoperative period</b>					
Yes	28	82.4	6	17.6	<b>0.005</b>
No	245	57.5	181	42.5	
<b>Blood transfusion in the intraoperative period</b>					
Yes	58	77.3	17	22.7	<b>0.001</b>
No	215	55.8	170	44.2	

**Use of AP\* in the postoperative period**

Yes	210	60.5	137	39.5	0.370
No	63	55.8	50	44.2	

\*AP= Antiplatelet drugs

In the multivariate analysis, age group, intraoperative complications and intraoperative blood transfusion were factors that continued to be statistically significant ( $p < 0.05$ ), and were

considered independent predictors of blood transfusion in the postoperative period of cardiac surgery (Table 5).

**Table 5.** Logistic regression of factors associated with blood transfusion in the postoperative period of cardiac surgery. Uberaba, Minas Gerais, 2005-2010.

Variables	Blood transfusion in the postoperative period				OR (CI)*	p
	Yes		No			
	n	%	n	%		
<b>Age group</b>						
Elderly	132	71.4	53	28.6	2.00 (1.31-3.07)	<b>0.001</b>
Adult	141	51.3	134	48.7		
<b>SAH</b>						
Yes	205	63.1	120	36.9	1.15 (0.73-1.79)	0.551
No	68	50.4	67	49.6		
<b>COPD</b>						
Yes	39	75.0	13	25.0	1.72 (0.86-3.41)	0.123
No	234	57.4	174	42.6		
<b>Duration of Surgery</b>						
4 hours or more	133	69.3	59	30.7	1.49 (0.98-2.28)	0.064
Less than 4 hours	140	52.2	128	47.8		
<b>Complications in the intraoperative period</b>						
Yes	28	82.4	6	17.6	2.71 (1.06-6.90)	<b>0.037</b>
No	245	57.5	181	42.5		
<b>Blood transfusion in the intraoperative period</b>						
Yes	58	77.3	17	22.7	2.02 (1.10-3.71)	<b>0.023</b>
No	215	55.8	170	44.2		

\* Odds ratio (Confidence Interval)

## DISCUSSION

Blood transfusion in cardiac surgery is very common, especially in MRV. Patients who undergo cardiac surgery tend to receive more blood transfusions than other surgery patients (WILLIAMS et al., 2011; MOHNLE et al., 2010; CAPRARO et al., 2007). According to Karkouti et al. (2006), the incidence of blood transfusion during cardiac surgery varies from 27.0% to 92.0%.

A study by Shander et al. (2009) evaluated the need for blood transfusion in different types of surgeries, and observed that in orthopedic surgeries blood transfusion was necessary for only 15.7% of patients, while in cardiac surgeries the percentage rose to 55.6%.

### Patient characteristics

The mean age of patients in this study was 57.9 years. This result differs from other studies, in which the mean age was 64 years (BANBURY et al., 2006), 63.8 years for women, 61.8 years for men (WILLIAMS et al., 2011), 59.5 years (CHALEGRE et al., 2011) and 50.7 years, respectively (SOUZA; MOITINHO, 2008). In regards to gender, a prevalence of men was observed in this study, which is similar to other studies (BANBURY et al., 2006; KOCH et al., 2006; ROGERS et al., 2007; CHALEGRE et al., 2011; DORNELES et al., 2011; WILLIAMS et al., 2011). Given the reality of population aging, the findings of this study point out the importance of studies that focus on risk factors

for heart disease, since the adult population was prevalent in this study.

The mean BMI observed in the study was 25.4 kg/m<sup>2</sup>, which substantiates obesity as a risk factor for heart disease and is similar to the result of another study in which the mean BMI was 26 kg/m<sup>2</sup> (WERLANG et al., 2008). In other studies, 48.7% of men had a BMI between 25 and 29.9 kg/m<sup>2</sup>, while 34.7% of women had a BMI less than 25 kg/m<sup>2</sup>. Less than 1.0% of the patients who received blood transfusions had a BMI less than 20 kg/m<sup>2</sup> (ROGERS et al., 2007; VAN STRATEN et al., 2010).

In regards to clinical condition, a prevalence of patients with severe systemic disease (American Society of Anesthesiologists classification P3) was evident, which was similar to another study (SHANDER et al., 2009). Among the comorbidities, SAH was common, which was also observed in another study involving patients who received blood transfusions during cardiac surgery (BANBURY et al., 2006; KOCH et al., 2006; SOUZA; MOITINHO, 2008; ; WERLANG et al., 2008; MOHNLE et al., 2010; DORNELES et al., 2011; WILLIAMS et al., 2011).

### **Characteristics of the surgery and blood transfusion**

The mean preoperative hospitalization time was 7.9 days, and the mean preoperative time spent in the ICU was 5.4 days, which differs from another study in which the mean time was two to three days (MANNIEN et al., 2011). It is worth noting that the lower preoperative hospitalization time, the lower the risk of postoperative complications occurring. The mean postoperative hospitalization time of 14 days corroborates another study in which the mean time was 13 days (DORNELES et al., 2011).

The majority of surgeries performed were elective, which corroborates other studies in which the frequencies of emergency surgeries were 2.3% and 8.4%, respectively (BANBURY et al., 2006; VAN STRATEN et al., 2010). Similar to other studies, MRV was the type of cardiac surgery that most frequently required the use of blood transfusion (ROGERS et al., 2007; SOUZA; MOITINHO, 2008; WERLANG et al., 2008; DORNELES et al., 2011; MANNIEN et al., 2011).

In regard to the use of CPB in cardiac surgeries requiring blood transfusion in literature the majority used this method of support, with use sometimes approaching 100% of procedures (BANBURY et al., 2006; SOUZA; MOITINHO, 2008). One study showed that only 4.2% of cardiac surgeries with blood transfusion did not use CPB as

a support (VAN STRATEN et al., 2010), and in another study, by Dorneles et al. (2011), only 3.4% of patients underwent cardiac surgery without CPB. The mean duration of CPB was 83.4 minutes, which corroborated other studies with a mean time less than 120 minutes (LOURES et al., 2000; SOUZA; MOITINHO, 2008; MOHNLE et al., 2010).

Corroborating other studies, red blood cell concentrate was the predominant type of blood product used in blood transfusions (BANBURY et al., 2006; CAPRARO et al., 2007; MANNIEN et al., 2011; WILLIAMS et al., 2011). The mean number of units of red blood cell concentrate used in the intraoperative period was 2.2 units per patient, and 3.6 units per patient in the postoperative period. This data is considerably greater than the mean use of 1.45 units of red blood cell concentrate per patient in cardiovascular surgery (SOUZA; MOITINHO, 2008).

In regard to the use of other blood products during the intra- and postoperative periods, a large quantity of units transfused per patient was observed, with relatively higher frequencies of transfusions of plasma (34/1%) and cryoprecipitate (5.1%). In literature (SOUZA; MOITINHO, 2008), a mean use of 0.75 UI per patient of fresh frozen plasma was observed, along with 1.43 UI of thrombocytes per patient, and 0.89 UI of cryoprecipitate per patient. Another study showed that 21.0% of patients received transfusions of thrombocyte concentrate in the postoperative period, 13.0% received fresh plasma and 3.0% received cryoprecipitate (BANBURY et al., 2006).

It was shown that the primary blood product transfused in cardiac surgeries was red blood cell concentrate. One study showed that 34.5% of patients received at least one unit, 22.7% of patients received one to two units, 8.6% received between three to five units of red blood cell concentrate, 3.1% received between six to 10 units, and 0.7% of patients received more than 10 units of red blood cell concentrate, with a mean of 0.75 IU of red blood cell concentrate per patient (VAN STRATEN et al., 2010).

The high use of red blood cell concentrate in cardiac surgeries may be related to the risk of bleeding, which, according to Souza and Moitinho (2008), is one of the most frequent complications in cardiovascular surgeries. This would justify the consumption of this blood product.

In regards to sternal reopening, 3.1% of patients required this treatment due to bleeding. In another study, (DORNELES et al., 2011) showed that 1.98% underwent surgical re-exploration, also due to bleeding.

### Factors associated with blood transfusion

In regards to factors associated with blood transfusion in the postoperative period, following multivariate analysis it was shown that the variables age group, complications and intraoperative blood transfusion were independent predictors of the outcome.

Age as a predictor of blood transfusion was corroborated by another study, which highlights that as patient age increases, so does the probability of the patient receiving transfusion of red blood cell concentrate (KOCH et al., 2006). Other studies also showed advanced age as a risk factor for intra- and postoperative blood transfusion (MAGOVERN et al., 1996; KARKOUTI et al., 2001; KARKOUTI et al., 2006; SHEHATA et al., 2007; SOUZA; MOITINHO, 2008; VAN STRATEN et al., 2010; SÁ et al., 2011).

Regarding the relationship between advanced age and blood transfusion in the postoperative period, one study reported that the high rate of transfusion in this age group is due to anemia already present in the preoperative period (42%), combined with surgical complications that lead to blood loss. The authors note that this age group has a low BMI, which is often a reflection of poor nutrition and health, which can lead to surgical complications and the need for blood transfusion in the intra- and postoperative periods (VEENITH et al., 2010).

Intraoperative complication as a predictive factor was not corroborated by one study that associates complications in this surgical phase with postoperative blood transfusion, among them cardiac arrest, infection of the surgical wound and gastrointestinal bleeding (MAGOVERN et al., 1996).

Bleeding is one of the primary complications in the intraoperative period of MRV surgeries that can lead to the need for transfusion. Some studies have investigated the possible causes that can lead patients to develop bleeding, and the factors that are predictors of the need for blood transfusion, among them low hematocrit and hemoglobin in the preoperative period, presence of comorbidities such as insulin-dependent diabetes mellitus, and peripheral vascular disease, myocardial infarction in the preoperative period, surgical re-exploration for any reason, and use and length of time of CBP (SOUZA; MOITINHO, 2008; VAN STRATEN et al., 2010).

### Blood transfusion predictors

Most cardiac surgeries are performed using the support of CBP. One study researched this

theme and showed that the use of this support and prolonged time of use both increase the risk of bleeding, and consequently the need for blood transfusion, specifically of red blood cell concentrate. In the 26.7% of cardiac surgeries in which CPB was used for longer than 120 minutes, 63% required blood transfusion. Of the 74 surgical procedures performed with a CPB time of less than 120 minutes, only 4% were transfused with four or five units of red blood cell concentrate (SOUZA; MOITINHO, 2008).

According to literature, low hematocrit and hemoglobin values in the preoperative (pre-procedural anemia) or intraoperative period, along with comorbidities or severe clinical complications, presented a relationship independent of the need for blood transfusion in the intra- and post-surgical period by unleashing complications in the intraoperative period such as blood loss, increasing the risk of allogeneic transfusions (MAGOVERN et al., 1996; KARKOUTI et al., 2001; KARKOUTI et al., 2006).

The independent predictors for blood transfusion in the postoperative period presented in this study are supported by one recent study, which presented a hematocrit  $\leq 40.0\%$ , use of CPB and number of distal anastomoses as independent risk factors for the prediction of blood transfusion in the postoperative period of MRV surgeries (SÁ et al., 2011)

### Study limitations

Retrospective studies can mean loss of data due to loss of medical records. Thus, a future prospective study is recommended. However, it is emphasized that in this study there was no compromise of the findings in response to the objectives proposed.

### CONCLUSIONS

Blood transfusions are still frequently used in cardiac surgeries, primarily MRV, with red blood cell concentrate being the predominant blood product administered in the intra- and post-surgical period.

Blood transfusion in the postoperative period is correlated with age, complications and blood transfusion in the intraoperative period. In light of the scarcity of studies regarding this topic, new studies that can corroborate or dispute the data presented in this study are necessary. The need to further discuss blood transfusion practices in cardiac surgeries, and to increase the awareness of surgical teams about the importance of the rational use of

blood products is emphasized, thus minimizing risks and guaranteeing the safety and quality of the transfusion process.

**RESUMO:** Este estudo tem por objetivo identificar os fatores associados à transfusão sanguínea no pós-operatório de cirurgia cardíaca e os tipos predominantes de produtos hemocomponentes utilizados. Estudo analítico e retrospectivo realizado em um hospital de grande porte, de ensino localizado em Uberaba, Minas Gerais, Brasil. Os dados foram coletados a partir de 460 prontuários de pacientes submetidos à cirurgia cardíaca entre julho de 2005 e julho de 2010. Foram 290 (63%) pacientes que receberam transfusões de sangue no período intra e ou pós-operatório. A idade média foi 57,9 anos; 59,6% eram do sexo masculino; 74,8% apresentavam hipertensão arterial sistêmica como comorbidade; e 97,2% das cirurgias foram eletivas, com revascularização do miocárdio sendo o tipo de cirurgia mais prevalente. No intra-operatório, 75 (25,9%) pacientes receberam transfusões sanguíneas, e no pós-operatório 273 (94,1%) receberam transfusões sanguíneas com concentrado de glóbulos vermelhos e foi o produto predominantemente utilizado. Houve uma associação estatisticamente significativa entre transfusão sanguínea no pós-operatório e as variáveis faixa etária, transfusão sanguínea e complicações intra-operatórias. A transfusão sanguínea continua a ser um procedimento frequente em cirurgias cardíacas, e faixa etária, complicações e transfusão de sangue intra-operatórias foram preditores independentes para ocorrência de transfusão sanguínea no pós-operatório.

**PALAVRAS-CHAVE:** Procedimentos de cirurgia cardíaca. Transfusão de sangue. Epidemiologia. Fatores de risco.

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